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| APPLICATION NO.  | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO.     | CONFIRMATION NO.       |
|--|-------------|----------------------|-------------------------|------------------------|
| 10/580,740   | 04/12/2007  | Johann Helneder      | 10808/330(In 1344WOUS)  | 9382                   |
| 48581 7590 03/09/2009<br>BRINKS HOFER GILSON & LIONE/INFINEON<br>INFINEON<br>PO BOX 10395<br>CHICAGO, IL 60610 |             |                      | EXAMINER<br>VAN, LUAN V |                        |
|  |             |                      | ART UNIT<br>1795        | PAPER NUMBER           |
|  |             |                      | MAIL DATE<br>03/09/2009 | DELIVERY MODE<br>PAPER |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

|                              |                                      |  |  |
|------------------------------|--------------------------------------|--|--|
| <b>Office Action Summary</b> | <b>Application No.</b><br>10/580,740 | <b>Applicant(s)</b><br>HELNEDER ET AL. |  |
|                              | <b>Examiner</b><br>LUAN V. VAN       | <b>Art Unit</b><br>1795                |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 07 January 2009.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 15-38 is/are pending in the application.
- 4a) Of the above claim(s) 23-28 and 34-38 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 15-22, 29-33 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>05/26/06</u> .  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Election/Restrictions***

Applicant's election of claims 15-22 and 29-33 in the reply filed on January 7 2009 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

### ***Claim Status***

Claims 15-38 are pending in the present application. Claims 15-22 and 29-33 are elected and examined.

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 20, 32 and 33 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 20, the instant claim recites "a base layer" which is used to describe the first electroplated layer and is different from the electrically conductive base layer, or barrier layer, in claims 15, 18 in 19. It is suggested that the applicant use a different term to describe this first electroplated layer to avoid confusion with the barrier layer also called the base layer.

Regarding claim 32, the limitation of "the boundary layer" lacks antecedent basis, and is dependent on claim 23 which is withdrawn. It appears that the applicant intended the boundary layer to be the covering layer and is dependent on claim 20 or 21.

Regarding claim 33, the limitation of "the tin alloy" lacks antecedent basis.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 15, 18-22 and 31-33 are rejected under 35 U.S.C. 102(b) as being anticipated by Fanti et al. (US patent 6622907).

Regarding claim 15, Fanti et al. teaches method for electroplating comprising: applying an electrically conductive base layer 16 (Fig. 4) to a substrate 9; applying an auxiliary layer 22 having a better electrical conductivity in comparison with the base layer after applying the base layer; applying a mask layer PR after applying the auxiliary layer; producing a mask with at least one mask opening 23 from the mask layer; patterning the auxiliary layer using the mask (i.e., etching layer 22, column 11 lines 52-58), wherein the base layer is not patterned or not completely patterned according to the mask (see Fig. 4C); and electroplating at least one layer in the mask opening after the patterning of the auxiliary layer (column 12 lines 8-11).

Regarding claim 18, Fanti et al. teaches applying an insulating layer 14 prior to applying the base layer 16, patterning the insulating layer 14 by producing a contact opening prior to the application of the base layer (Fig. 4A); and applying a part of the base layer 16 in the contact opening (Fig. 4A).

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Regarding claim 19, Fanti et al. teaches wherein applying the base layer comprises applying a barrier layer 16 (made of tungsten or titanium-tungsten, column 9 lines 9-12) against copper diffusion, and wherein applying the auxiliary layer comprises applying a layer comprising copper (column 9 lines 22-25).

Regarding claim 20, Fanti et al. teaches electroplating a base layer 28 (i.e., electroplating nickel layer, column 12 lines 13-19); and electroplating a covering layer 26 (i.e., solder bump) after the electroplating of the base layer, and wherein the base layer comprises a different material from the covering layer.

Regarding claim 21, since the base layer, i.e. nickel, and the covering layer, i.e. lead-tin alloy, of Fanti et al. is made of the same material as that of the instant claim, they would inherently have the same melting point properties of the instant claim.

Regarding claim 22, Fanti et al. teaches wherein patterning of the auxiliary layer comprises galvanic patterning (i.e., electrolytic dissolution, column 9 lines 45-46) of the auxiliary layer.

Regarding claim 31, Fanti et al. teaches wherein the galvanic patterning comprises galvanic patterning (i.e., electroetching, column 10 lines 55-61) in the same installation as the electroplating of the layer in the mask opening.

Regarding claim 32, Fanti et al. teaches solders such as SnCuAg, a ternary compound, can be used (column 10 lines 29-32).

Regarding claim 33, Fanti et al. teaches lead-tin alloy (column 10 line 18).

***Claim Rejections - 35 USC § 103***

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The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 16, 17, 29 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fanti et al. in view of Shimo et al. (US pub 2003/0102223).

Fanti et al. teaches the method as described above. Fanti et al. differs from the instant claims in that the reference does not explicitly teach whether the second current density is higher than the initial current density (claim 16), or the specific current density and time duration of the instant claims (claims 17, 29 and 30).

Shimo et al. teach is a method of electroplating copper in a via hole formed on a multilayer substrate comprising the steps of applying a current density of equal to or less than 1.5 ampere per square decimeter to deposit copper film having a thickness of 1  $\mu\text{m}$  or more, and applying a current density on the order of 3 ampere per square decimeter in the second stage (paragraph 22). By performing the electroplating process using a lower initial current, deposition of dendrite crystals is prevented and copper is

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electrolytically plated densely and uniformly on the surface of the chemical copper plating layer. Also, voids, which affect the reliability, do not occur in the via holes, so that the via holes is plated in a short time (paragraph 36).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used a low initial current density as taught by Shimo et al. in the method of Fanti et al., because it would prevent the formation of voids in the via holes, and because it would electroplate a dense and uniform layer of metal in the via holes (paragraph 36 of Shimo et al.). Since the electroplating time determines the thickness of the electroplated metal, it would have been obvious to one having ordinary skill in the art to have further modified the electroplating time in order to electroplate metal layers having the desired thickness. While Shimo et al. is directed to method of plating copper in via holes and Fanti et al. is directed to electroplating via holes for forming a solder bump, both are directed to a process of electroplating a metal in via holes, therefore one having ordinary skill in the art would have a reason with expectation of success from the combination.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to LUAN V. VAN whose telephone number is (571)272-8521. The examiner can normally be reached on M-F 9:30-6:00.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Nam X Nguyen/  
Supervisory Patent Examiner, Art Unit 1753

LVV  
March 2, 2009